UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 15, 2021

Ms. Cheryl A. Gayheart
Regulatory Affairs Director
Southern Nuclear Operating Co., Inc.
3535 Colonnade Parkway
Birmingham, AL 35243

SUBJECT: VOGTLE ELECTRIC GENERATING PLANT, UNITS 1 AND 2 – CLOSEOUT OF GENERIC LETTER 2004-02, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS" (EPID: L-2020-LLA-0182)

Dear Ms. Gayheart:

The U.S. Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated September 13, 2004 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML042360586), requesting that licensees address the issues raised by Generic Safety Issue (GSI) 191, "Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance."

GL 2004-02 requested information for nuclear power plant licensees to demonstrate compliance with Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors." Specifically, the GL requested licensees to perform an evaluation of the emergency core cooling system (ECCS) and containment spray system (CSS) recirculation and, if necessary, take additional action to ensure system function based on potential susceptibility to blockage during design-basis accidents. The focus of the assessment was on those accidents requiring recirculation operation of the ECCS or CSS, and on potential adverse effects due to debris blockage of flowpaths necessary for ECCS and CSS recirculation and containment drainage.

GL 2004-02 requested holders of operating licenses for pressurized-water reactors to perform a mechanistic evaluation, using an NRC-approved methodology, perform a mechanistic evaluation of the potential for the adverse effects of post-accident debris blockage and operation with debris-laden fluids to impede or prevent the recirculation functions of the ECCS and CSS following all postulated accidents for which the recirculation of these systems is required. The GL also requested that holders of operating licenses for pressurized-water reactors implement any plant modifications that the evaluation identifies as necessary to ensure system functionality and provide information regarding planned actions and the schedule for completing the requested evaluation.

The GL was issued pursuant to 10 CFR 50.54(f) and requested information, including the following:

1. Within 90 days of the date of the safety evaluation report providing the guidance for performing the requested evaluation, addressees are requested to provide information regarding their planned actions and schedule to complete the requested evaluation. The information should include the following:

   (a) A description of the methodology that is used or will be used to analyze the susceptibility of the ECCS and CSS recirculation functions for your reactor to the adverse effects identified in this generic letter of post-accident debris blockage and operation with debris-laden fluids identified in this generic letter. Provide the completion date of the analysis that will be performed.

   (b) A statement of whether you plan to perform a containment walkdown surveillance in support of the analysis of the susceptibility of the ECCS and CSS recirculation functions to the adverse effects of debris blockage identified in this generic letter. Provide justification if no containment walkdown surveillance will be performed. If a containment walkdown surveillance will be performed, state the planned methodology to be used and the planned completion date.

2. Addressees are requested to provide the following information no later than September 1, 2005:

   (a) Confirmation that the ECCS and CSS recirculation functions under debris loading conditions are or will be in compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of this generic letter. This submittal should address the configuration of the plant that will exist once all modifications required for regulatory compliance have been made and this licensing basis has been updated to reflect the results of the analysis described above.

   (b) A general description of and implementation schedule for all corrective actions, including any plant modifications, that you identified while responding to this generic letter. Efforts to implement the identified actions should be initiated no later than the first refueling outage starting after April 1, 2006. All actions should be completed by December 31, 2007. Provide justification for not implementing the identified actions during the first refueling outage starting after April 1, 2006. If all corrective actions will not be completed by December 31, 2007, describe how the regulatory requirements discussed in the Applicable Regulatory Requirements section will be met until the corrective actions are completed.

   (c) A description of the methodology that was used to perform the analysis of the susceptibility of the ECCS and CSS recirculation functions to the adverse effects of post-accident debris blockage and operation with debris-laden fluids. The submittal may reference a guidance document (e.g., Regulatory Guide 1.82, Rev. 3, industry guidance) or other methodology previously submitted to the NRC. (The submittal may also reference the response to Item 1 of the Requested Information described above. The documents to be submitted or referenced should include the results of any supporting containment walkdown surveillance

performed to identify potential debris sources and other pertinent containment characteristics.)

(d) The submittal should include, at a minimum, the following information:

(i) The minimum available NPSH margin for the ECCS and CSS pumps with an unblocked sump screen.

(ii) The submerged area of the sump screen at this time and the percent of submergence of the sump screen (i.e., partial or full) at the time of the switchover to sump recirculation.

(iii) The maximum head loss postulated from debris accumulation on the submerged sump screen, and a description of the primary constituents of the debris bed that result in this head loss. In addition to debris generated by jet forces from the pipe rupture, debris created by the resulting containment environment (thermal and chemical) and CSS washdown should be considered in the analyses. Examples of this type of debris are disbonded coatings in the form of chips and particulates and chemical precipitants caused by chemical reactions in the pool.

(iv) The basis for concluding that the water inventory required to ensure adequate ECCS or CSS recirculation would not be held up or diverted by debris blockage at choke-points in containment recirculation sump return flowpaths.

(v) The basis for concluding that inadequate core or containment cooling would not result due to debris blockage at flow restrictions in the ECCS and CSS flowpaths downstream of the sump screen, (e.g., a HPSI throttle valve, pump bearings and seals, fuel assembly inlet debris screen, or containment spray nozzles). The discussion should consider the adequacy of the sump screen's mesh spacing and state the basis for concluding that adverse gaps or breaches are not present on the screen surface.

(vi) Verification that close-tolerance subcomponents in pumps, valves and other ECCS and CSS components are not susceptible to plugging or excessive wear due to extended post-accident operation with debris-laden fluids.

(vii) Verification that the strength of the trash racks is adequate to protect the debris screens from missiles and other large debris. The submittal should also provide verification that the trash racks and sump screens are capable of withstanding the loads imposed by expanding jets, missiles, the accumulation of debris, and pressure differentials caused by post-LOCA blockage under predicted flow conditions.

(viii) If an active approach (e.g., backflushing, powered screens) is selected in lieu of or in addition to a passive approach to mitigate the effects of the debris blockage, describe the approach and associated analyses.

(e) A general description of and planned schedule for any changes to the plant licensing bases resulting from any analysis or plant modifications made to ensure compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of this generic letter. Any licensing actions or exemption requests needed to support changes to the plant licensing basis should be included.

(f) A description of the existing or planned programmatic controls that will ensure that potential sources of debris introduced into containment (e.g., insulations, signs, coatings, and foreign materials) will be assessed for potential adverse effects on the ECCS and CSS recirculation functions. Addressees may reference their responses to GL 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment," to the extent that their responses address these specific foreign material control issues.

Southern Nuclear Operating Company (SNC, the licensee) responded to GL 2004-02 by various letters (see Enclosure), and addressed the information requested in the GL. By letter dated July 10, 2018 (ADAMS Accession No. ML18193B163), SNC submitted a Vogtle-specific technical report describing a risk-informed methodology to evaluate debris effects. By letter dated September 30, 2019 (ADAMS Accession No. ML19120A469), the NRC staff found that the technical report was acceptable for use in plant-specific licensing applications for Vogtle Electric Generating Plant (Vogtle), Units 1 and 2, in accordance with the limitations and conditions section and applicability provided in the NRC staff evaluation.

On August 17, 2020 (ADAMS Accession No. ML20230A346), SNC submitted an exemption request and a license amendment request (LAR) to resolve the concerns addressed in GL 2004-02, using a risk-informed approach. The license amendments were necessary because the risk-informed methodology was a departure from the method of evaluation described in the plants' licensing basis as provided in the updated final safety analysis report (UFSAR) and because changes to the SNC Technical Specifications were needed to identify operability limitations on the systems considering the impacts of debris. The licensee also requested exemptions from the regulations under 10 CFR 50.46(a)(1)(i), which require a deterministic approach.

In its approach, SNC combined probabilistic risk assessment (PRA) with traditional engineering analysis to evaluate the change in core damage frequency and change in large early release frequency. This approach used Vogtle, Units 1 and 2, PRA models for internal and seismic events. In accordance with Regulatory Guide (RG) 1.174, Revision 3, "An Approach for using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," and NUREG-1855, Revision 1, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making," SNC performed an uncertainty evaluation, which focused on change in core damage frequency and included parametric, model, and completeness considerations. Parametric and model uncertainties were evaluated through sensitivity runs. Completeness uncertainty was evaluated qualitatively. All parametric and model uncertainty/sensitivity results were found to be acceptable based on RG 1.174 guidance.

The licensee performed tests to determine the head loss induced by debris accumulation on the sump strainers using NRC guidance. A plant-specific, computer-aided design model was used

for containment to quantify the amount of debris generated for a range of pipe break locations, sizes, and orientations. Using these results, the licensee performed a risk analysis that demonstrated a negligible increase in risk caused by the generated debris. The NRC staff found that the completeness of this analysis supported closing out GL 2004-02.

During the NRC staff's review of the licensee's LAR, the NRC staff performed independent calculations, using conservative inputs, which confirmed that there were adequate margins in the licensee's results. The NRC staff concluded that the SNC analysis scope and level of detail were sufficient and that the PRA model used for the evaluation complies with RG 1.200, Revision 2, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," and can be applied in regulatory decision making.

On July 30, 2021 (ADAMS Package Accession No. ML21071A050), the NRC staff granted exemptions to the licensee from 10 CFR 50.46(a)(1)(i), which required the use of ~~a~~ deterministic or bounding analysis regarding the effects of debris following certain postulated accidents, and authorized Vogtle, Units 1 and 2, to use a risk-informed method to resolve the concerns addressed in GL 2004-02.

Also, on July 30, 2021 (ADAMS Package Accession No. ML21068A109), the NRC staff issued Amendment Nos. 206 and 189 to Vogtle, Units 1 and 2, respectively, allowing the use of a risk-informed approach for resolving the effects of debris on ECCS and CSS recirculation function following design-basis accidents.

Based on the evaluation and conclusions recited in the *Federal Register* notice for the exemptions and the NRC staff's safety evaluation for Amendment Nos. 206 and 189, the NRC staff finds that SNC has provided sufficient information in response to GL 2004-02 for Vogtle, Units 1 and 2. The NRC staff finds that the information provided by the licensee demonstrates that debris will not inhibit ECCS or CSS performance and the intended system functions in accordance with 10 CFR 50.46 to assure adequate long-term core cooling following a design-basis accident.

Based on the above, the NRC staff finds the licensee's responses to GL 2004-02 acceptable and considers GL 2004-02 closed for Vogtle, Units 1 and 2. No further information or action is requested of the licensee.

If you have any questions, please contact me at 301-415-3100 or at John.Lamb@nrc.gov.

Sincerely,

***/RA/***

John G. Lamb, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-424 and 50-425
Enclosure: As stated
cc: Listserv

ENCLOSURE

SNC LETTERS TO NRC REGARDING GL 2004-02

1. SNC Letter to NRC, Joseph M. Farley Nuclear Plant and Vogtle Electric Generating Plant September 2005 Response to NRC Generic Letter 2004-02 “Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors,” dated August 31, 2005 (ADAMS Accession No. ML052430146).

2. SNC Letter to NRC, Vogtle Electric Generating Plant - Units 1 and 2, Request for Extension for Completing Corrective Actions for Generic Letter 2004-02, “Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors,” dated June 22, 2006 (ADAMS Accession No. ML061730462).

3. SNC Letter to NRC, Vogtle Electric Generating Plant - Units 1 and 2, Response to NRC RAI on SNC Request for Extension for Completing Corrective Actions for Generic Letter 2004-02, “Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors,” dated July 28, 2006 (ADAMS Accession No. ML062120593).

4. SNC Letter to NRC, Vogtle Electric Generating Plant Units 1 and 2 Generic Letter 2004-02 Response Extension Request, dated December 7, 2007 (ADAMS Accession No. ML073440044).

5. SNC Letter to NRC, Vogtle Electric Generating Plant Supplemental Response to NRC Generic Letter 2004-02, dated February 28, 2008 (ADAMS Accession No. ML080640601).

6. SNC Letter to NRC, Vogtle Electric Generating Plant Supplemental Response to NRC Generic Letter 2004-02, dated May 21, 2008 (ADAMS Accession No. ML081640617).

7. SNC Letter to NRC, Vogtle Electric Generating Plant Units 1 and 2 Generic Letter 2004-02 Response Extension Request, dated May 22, 2008 (ADAMS Accession No. ML081430616).

8. SNC Letter to NRC, Vogtle Electric Generating Plant Generic Letter 2004-02 Response Extension Request, dated July 31, 2008 (ADAMS Accession No. ML082170487).

9. SNC Letter to NRC, Vogtle Electric Generating Plant Supplemental Response to NRC Generic Letter 2004-02, dated July 31, 2008 (ADAMS Accession No. ML082170513).

10. SNC Letter to NRC, Vogtle Electric Generating Plant Supplemental Response to NRC Generic Letter 2004-02, dated August 22, 2008 (ADAMS Accession No. ML082380890).

11. SNC Letter to NRC, Vogtle Electric Generating Plant Generic Letter 2004-02 Extension Request for Completion of Chemical Effects and Closeout of GL 2004-02, dated November 7, 2008 (ADAMS Accession No. ML083150262).

12. SNC Letter to NRC, Vogtle Electric Generating Plant - Units 1 and 2 - Supplemental Response to NRC Generic Letter 2004-02,” dated April 21, 2017 (ADAMS Accession No. ML17116A096).

13. SNC Letter to NRC, Vogtle Electric Generating Plant - Units 1&2, Response to Supplemental Information Needed for Acceptance of Systematic Risk Informed Assessment of Debris Technical Report," dated July 11, 2017(ADAMS Accession No. ML17192A245).

14. SNC Letter to NRC, "Vogtle Electric Generating Plant, Units 1&2 - Systematic Risk Informed Assessment of Debris Technical Report, SNC Response to NRC Request for Additional Information (RAIs #1-3)," dated November 9, 2017 (ADAMS Accession No. ML17314A014).

15. SNC Letter to NRC, "Vogtle Electric Generating Plant, Units 1 & 2 - Systematic Risk-Informed Assessment of Debris Technical Report SNC Response to NRC Request for Additional Information (RAIs #4-10)," dated January 2, 2018 (ADAMS Accession No. ML18004A070).

16. SNC Letter to NRC, Vogtle Electric Generating Plant, Units 1 and 2 - Response to NRC Request for Additional Information (RAIs #11-14) to Systematic Risk Informed Assessment of Debris Technical Report," dated January 9, 2018 (ADAMS Accession No. ML18009A841).

17. SNC Letter to NRC, "Vogtle Electric Generating Plant, Units 1 & 2 - Incorporate Seismic Probabilistic Risk Assessment ino the 10 CFR 50.69 Categorization Process, Response to Request for Additional Information (RAIs 1, 2, 3 & 12)," dated February 6, 2018 (ADAMS Accession No. ML18037B121).

18. SNC Letter to NRC, "Vogtle Electric Generating Plant, Units 1 and 2 - Systematic Risk Informed Assessment of Debris Technical Report SNC Response to NRC Request for Additional Information (RAIs #16-36)," dated February 12, 2018 (ADAMS Accession No. ML18045A094).

19. SNC Letter to NRC, Vogtle Electric Generating Plant, Units 1 and 2 - License Amendment Request to Incorporate Seismic Probabilistic Risk Assessment into the 10 CFR 50.69 Categorization Process, Response to Request for Additional Information (RAIs 4-11)," dated February 21, 2018 (ADAMS Accession No. ML18052B342).

20. SNC Letter to NRC, Vogtle Electric Generating Plant, Units 1 and 2 - Systematic Risk Informed Assessment of Debris Technical Report SNC Response to NRC Request for Additional Information (RAIs #37-39)," dated May 23, 2018 (ADAMS Accession No. ML18143B785).

21. SNC Letter to NRC, "Vogtle Electric Generating Plant, Units 1 and 2 - Supplemental Response to NRC Generic Letter 2004-02," dated July 10, 2018 (ADAMS Accession No. ML18193B162).

22. SNC Letter to NRC, Vogtle Electric Generating Plant, Units 1 and 2 - Systematic Risk Informed Assessment of Debris Technical Report Supplemental Information," dated December 4, 2018 (ADAMS Accession No. ML18338A497).

23. SNC Letter to NRC, "Vogtle Electric Generating Plant Proposed Path to Closure of Generic Safety Issue-191, "Assessment of Debris Accumulation on Pressurized-Water

Reactor Sump Performance”,” dated May 16, 2013 (ADAMS Accession No. ML13137A130).

24. SNC Letter to NRC, “Vogtle Electric Generating Plant, Units 1 and 2 - License Amendment Request to Modify Approved 10 CFR 50.69 Categorization Process,” dated June 22, 2017 (ADAMS Accession No. ML17173A875).

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